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STORAGE

REPORT

OF

THE DIRECTOR

OF THE

ROYAL OBSERVATORY, HONGKONG,

FOR THE YEAR

1913.

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1914.

REPORT OF THE DIRECTOR OF THE ROYAL OBSERVATORY, HONGKONG, FOR THE YEAR 1913.

I.—GROUNDS AND BUILDINGS.

In the month of June the Botanical Department planted an avenue of Latania palms, and cleaned the grounds.

In November the western portion of the grounds was converted into a playground for the children of the Kowloon British School.

The additions to the Main Building which were commenced in November, 1912, were completed in May, 1913.

The new thermograph shed was not ready for use by the end of the year.

II.—METEOROLOGICAL INSTRUMENTS.

Kew Barograph.—Comparisons of the measures of the barograms with the readings of the standard barometer, indicated that the Kew barograph was under-corrected for temperature. The temperature Compensator was accordingly adjusted on 1913, January 1, and again on November 7.

Beckley Anemograph—The instrument was cleaned and oiled once a month. In the month of July apparatus was added to the clock to keep the velocity pencil off the paper for 5 minutes each hour, as the 3-minute break made by the electric dial was found insufficient at low wind velocities.

Dines-Baxendell Anemograph.—The spindle of the float was cleaned once a week, and the head oiled once a month. The level of the water was adjusted when necessary. Registration on rolls of blank paper 40 feet long was commenced on November 8. As the clock spring was found to be too weak to perform the additional work of unwinding the paper off the spool, over the registering spindle on to the cylinder, 40 feet of silk cord was wound round a groove on the base of the cylinder and led over a pulley to a weight sufficiently heavy to overcome the additional friction. This plan has not proved altogether satisfactory. It is proposed to fit a stronger spring to the clock.

The monthly results of comparisons with the records of the Beckley Anemograph since the installation of the Dines instrument in April 1910, are given below :—

Month.	Factor (Dines $\div \frac{\text{Beckley}}{3}$).			
	1910.	1911.	1912.	1913.
January, ...	......	2·33	2·30	2.12
February, ...	......	2·34	2·32	2.30
March, ...	......	2·30	2·35	2.25
April,...............	......	2·27	2·33	2.26
May, ...	2·23	2·25	2·34	2.22
June,...............	2·23	2·10	2·44	2.09
July,...............	2·14	2·21	2·57	2.28
August,...............	2·07	2·25	2·65	2.39
September, ...	2·18	2·31	2·49	2.81
October, ...	2·30	2.27	2·51	2.69
November, ...	2·28	2·27	2·47	2.71
December,............	2·23	2·31	2·24	2.54
Year.	2·25	2·29	2·41	2.39

The mean factor for the year was practically the same as in 1912, but was considerably less from June to August, and considerably greater from September to the end of the year. The cause of these large variations is uncertain.

III.—METEOROLOGICAL OBSERVATIONS AT THE OBSERVATORY.

Continuous photographic records showing the variations of barometric pressure are obtained with a Kew barograph, and automatic records of the direction and velocity of the wind with a Beckley and a Dines-Baxendell anemograph, modified as described in the Report for 1912. The amount of rain is recorded automatically by a Beckley and a Nakamura pluviograph, the amount of sunshine by a Campbell-Stokes universal sunshine recorder, and the relative humidity of the air by a small Richard hair hygrograph.

Eye observations of barometric pressure, temperature of the air and of evaporation were made at each hour of Hongkong Standard time. (Until the end of the year 1912 they were made at each hour of Hongkong Local time.) The character and direction of motion of the clouds were observed every three hours. Daily readings were taken of self-registering maximum and minimum thermometers.

Principal Features of the Weather in 1913.—The principal feature of the weather in the year 1913 was the irregular distribution of rainfall. The fall was 4 inches above normal in March, 2½ inches above in July and 5 inches in September, and was 3 inches below normal in April, 2½ inches below in May, 4 inches in August, and 1½ inches in October. The total rainfall for the year was 83,73 inches, or 0·56 inch above normal.

A drought occurred from October 12 to December 8, broken only by a fall of 0·03 inch of rain on November 8 and 0·71 inch on November 13 to 15. This would have caused a shortage in the water supply had it not been for the rain which fell in the typhoon of September 17 to 20.

Pressure was moderately above normal in January, October, November and December, and moderately below normal in April and July.

Temperature was 2°·1 above normal in February and 1°·9 below normal in December. In the remaining months the departure from normal did not exceed 1°·0.

The mean temperature for the year was 71°·9 or 0°·2 above normal. The highest temperature was 92°·0 on July 20 and August 16, as against 91°·3 in 1912 and 97°·0 for the past 30 years. The lowest temperature was 44°·0 on January 26 as against 45°·3 in 1912, and 32°·0 for the past 30 years.

According to the records of the Beckley Anemograph the wind velocity was below normal in each month of the year, but there is evidence to show that the instrument is more sluggish than formerly, the mean velocity for the period 1884 to 1900 being 13·21 m.p.h., and for the period 1901 to 1913 only 12·41 m.p.h. This represents a defect of 92,000 miles of wind in the last 13 years.

Rainfall at the Observatory, Botanical Gardens and Taipo compared:—

In the following table the rainfall at the Observatory is compared with the fall at the Police Station, Taipo, and the Botanical Gardens, Hongkong.

Months.	Observatory (*Kowloon*).	Police Station (*Taipo*).	Botanical Gardens (*Hongkong*).
	inches.	*inches.*	*inches.*
January,	1·025	1·11	0·87
February,	2·390	2·58	2·16
March,	6·945	7·47	8·13
April,	2·175	2·21	3·33
May,	9·300	7·23	10·35
June,	16·035	27·54	17·73
July,	15·050	15·22	15·39
August,	10·565	16·37	13·45
September,	14·570	13·65	15·92
October,	3·550	0·60	2·14
November,	0·740	1·39	1·25
December,	1·385	0·97	1·70
Year,	83·730	96·34	92·42

Typhoons.—A typhoon passed within 50 miles to the south of the Observatory at about 11 a.m. on August 17, when the barometer fell to 29·316 inches, and the wind attained a mean velocity of 86 m.p.h., as recorded by the Beckley Anemograph. A squall at the rate of 105 m.p.h. was recorded by the Dines Anemograph at 11^h 36^m a.m. This storm was travelling at the rate of 24 miles per hour when passing Hongkong. A second typhoon passed within 100 miles to the north of the Observatory in the early morning of September 19, the barometer falling to 29·279 inches at 1 a.m. The maximum wind velocity for one hour, as recorded by the Beckley Anemograph, was 56 miles at 1^h a.m., and the maximum squall velocity, as recorded by the Dines Anemograph, 70 miles at 1^h 15^m a.m. 4 inches of rain fell in the first typhoon and 6 inches in the second. Owing to their short duration, comparatively little damage was done by either storm, though in the second a certain amount of unlooked-for damage was caused on account of its unusual track, and the consequent strong winds from westward instead of from eastward.

The tracks of 14 typhoons and 8 of the principal depressions which occurred in the Far East, in the year 1913, are shown on two plates in the Monthly Meteorological Bulletin for December.

IV.—WEATHER FORECASTS AND STORM WARNINGS.

Daily Weather Report.—A weather map of the Far East, and the Daily Weather Report, containing meteorological observations, usually at 6 a.m. and 2 p.m. from about 40 stations in China, Indo-China, Japan, and the Philippines, and a daily weather forecast for Hongkong and district, the Formosa Channel, the south coast of China between Hongkong and Hainan, and the south coast of China between Hongkong and Lamocks, were issued as in former years. Copies of the map were exhibited on notice boards at the Hongkong Ferry Pier, the Blake Pier, and the Harbour Office. One copy was sent daily to the Director of the Meteorological Observatory, Macao. Seventy copies of the Daily Weather Report were distributed to various offices, &c., in the Colony, and a copy was sent daily to the Director of the Meteorological Observatory, Macao. Copies were sent every week to the Hydrographic Office, Tokio, and the Lieut.-Commander Pradyat, Royal Siamese Navy; and every 10 days to the Director, Central Meteorological Observatory, Phulien.

The Monthly Meteorological Bulletin, which includes the Daily Weather Report, was distributed to the principal Observatories and scientific institutions of the world.

Owing to the increasing demand for the Daily Weather Report, and the consequent late delivery to some firms, it was decided to charge a subscription of $10 a year for the Report, as in England, from 1914 January 1, with a view to confining the distribution list to the firms, etc., most vitally concerned, and hence accelerate delivery.

Daily Weather Telegrams.—In the month of October, by the courtesy of the Harbour Master, and by permission of the Chinese

Customs Authorities, the 6 a.m. and 2 p.m. observations from Canton were substituted for the 9 a.m. and 3 p.m. observations sent formerly. This is another step towards synchronous meteorological reports from all stations in China.

I am unable to report any improvement in the service of weather telegrams from Hoihow and Pakhoi. On the few occasions when they have been received they have arrived too late to be utilised for the weather map.

The service of weather telegrams from the interior of China, which was interrupted during the rebellion, re-commenced at the end of October and has been continued with more or less regularity since, though the morning observations are never received in time to be utilised for the Weather Map, except those from Kiu Kiang occasionally. The previous afternoon's observations are frequently of considerable value, however.

Extra Weather Telegrams.—In the month of October Canton was added to the list of stations sending extra weather telegrams during typhoons, on receipt of certain code words from Hongkong. Other stations from which such messages are received are Manila, or some other station in the Philippines nearer the typhoon centre, Taihoku, Phulien, Macao, Amoy, and Sharp Peak.

From May to October the 9 p.m. observations at Swatow were forwarded to the Observatory by the Customs Authorities as in previous years. On the whole, the observations were delayed less than usual, but were occasionally not received.

By the courtesy of the Naval Authorities meteorological observations made on board His Majesty's ships were occasionally forwarded to the Observatory by wireless telegraphy.

Results of Weather Forecasts.—The results of comparison of the daily weather forecasts with the weather subsequently experienced are given below, with the results of the previous five years:—

Year.	Complete Success.	Partial Success.	Partial Failure.	Total Failure.
	%	%	%	%
1908....................	59	31	9	1
1909....................	58	32	8	2
1910....................	58	32	9	1
1911....................	55	32	11	2
1912....................	62	34	3	1
1913....................	66	28	3	3

The forecasts comprise wind direction and force, and weather. Two elements correct constitutes a partial success and only one element correct constitutes a partial failure.

Storm Warnings.—Storm warnings according to the "China Coast" code, and the Local code, were displayed when necessary. Others according to the Hongkong telegraphic code were sent to the following ports:—Amoy, Swatow, Sharp Peak, Macao, Canton, Pakhoi, Hoihow, Phulien, Manila, Labuan, and Singapore. For the benefit of vessels taking shelter in Kowloon Bay and to the west of Stonecutters Island, the local warnings are repeated at Lyemun by the Military Authorities and at Lai-Chi-Kok by the Standard Oil Company.

V.—METEOROLOGICAL OBSERVATIONS FROM SHIPS, TREATY PORTS, &C.

Logs received.—In addition to meteorological registers kept at about 40 stations in China, meteorological logs were received from 290 ships operating in the Far East. These logs, representing 18,006 days' observations, have been utilised for determining typhoon tracks. The corresponding figures for the year 1912 were 334 and 23,202.

Comparison of Barometers.—During the year several hundred indirect comparisons of ships' barometers have been made, and direct comparison of barometers for several ship masters and various persons in the Colony.

Material for Pilot Chart.—The entry of sea observations into degree squares for the area 9° South to 45° North Latitude, and 100° to 180° East Longitude, has been discontinued, except for squares containing less than 50 observations. For those containing more than 50 observations means are being formed and the observations collected into two-degree squares. The work has been delayed, however, owing to the extra work thrown upon the First Assistant during the absence on leave of the Assistant Meteorologist since May 28.

VI.—MAGNETIC OBSERVATIONS.

Absolute determinations of magnetic horizontal force, dip, and declination were made near the middle of each month with instruments of the Kew pattern. In the determinations of horizontal force two sets of deflection observations were made, one before and one after the vibration observations. Four dip needles were used in rotation, two on one day of each month.

Preparatory to a magnetic survey of the New Territories, magnetometer No. 83 was compared with No. 55 (the instrument used for the routine observations) and observations of declination and horizontal force made at 2 points in Taipo on March 8. The instrument is not suitable for survey work however. Provision has been made in the Estimates for 1914 for certain improvements to this instrument and also for the purchase of an earth inductor.

Beginning with the year 1912 the observations of horizontal force have been reduced by the aid of three tables, the first giving the correction to log T. for varying chronometer rates and arcs of vibration (mean of the arcs at the beginning and end of the observations), the second giving values of

$$\log. \pi^2 K - \log \left\{ 1 + \frac{H}{F} + \mu\frac{X_0}{m_0} - (qt + q't^2) \right\}$$

for varying values of t, when $(1 + \frac{H}{F} + \mu\frac{X_0}{m_0}) = 1{\cdot}00354$, with a subsidiary table of corrections for any departure from this value; and the third giving the values of

$$\log. \left\{ 1 + \frac{2\mu}{r^3} + (qt + q't^2) \right\} + \log. \frac{r^3}{2} + \log. \left(1 - \frac{P}{r^2} \right)$$

for varying values of t, and two values of r, namely, 30 cms. and 40 cms. The value of P used in this table was 7·05 (the mean of the years 1910-12). The computations are considerably shortened by using these tables.

The mean values of the magnetic elements for the years 1912 and 1913 were as follows:—

	1912.	*1913.*
Declination (west)	0° 4′ 16″	0° 6′ 13″
Dip (north)	30 56 20	30 53 41
Horizontal Force (C.G.S. unit)	0·37193	0·37172
Vertical Force (C.G.S. unit)	0·22294	0·22242
Total Force (C.G.S. unit)	0·43363	0·43318

VII.—MISCELLANEOUS.

Time Service.—The Time Service installation is now practically complete except for new pendulums to the Dent clocks, and a return signal from the Time Ball to the Observatory chronograph. A detailed description of the installation, together with a discussion of the rates of the electric transmitter under varying conditions of friction and impulse, is in course of preparation.

Time-Ball.—Since the beginning of the year 1913 the time-ball on Blackhead Hill has been dropped daily, Sundays and General Holidays included, at 13^h Hongkong Standard Time (5^h a.m. of Greenwich Time). It was also notified in the *Gazette*, Notification No. 391 of 1912 December 27, that the time-ball would be dropped at any other hour in case of necessity. Advantage was taken of this regulation on only one occasion, on April 1, when the ball was dropped at 16^h as well as 13^h, at the request of the King's Harbour Master. The ball was dropped successfully 354 times. There were 6 failures, two caused by mistakes of the Chinese computer in the time-ball tower, and the remainder by electrical defects. It is proposed to run the time-ball wire along the Railway with a view to preventing interference and accidental earthing or contact with other lines. The winding pinion was found broken on March 7, the ball having probably been allowed to fall on the previous day without disconnecting the pinion from the rack. A new pinion was fitted by the Hongkong & Whampoa Dock Co. on March 11.

The ball was not raised on August 17 owing to high wind. It fell with an error of $0^{s}{\cdot}3$ or less on 297 occasions, with an error of $0^{s}{\cdot}4$ or $0^{s}{\cdot}5$ on 34 occasions, and $0^{s}{\cdot}6$ or $0^{s}{\cdot}7$ on 12 occasions. Errors of $0^{s}{\cdot}8$ occurred 5 times, of $0^{s}{\cdot}9$, $1^{s}{\cdot}0$, $1^{s}{\cdot}1$ and $1^{s}{\cdot}8$ once each, and of $1^{s}{\cdot}3$ twice. The probable error varied from $0^{s}{\cdot}53$ in March to $0^{s}{\cdot}10$ in June.

Observations for Time.—Observations for time were made daily with a 3-inch transit instrument, weather permitting. 1,118 transits were observed during the year. The errors of level and azimuth were determined 308 and 80 times respectively, and the line of collimation 47 times. The corresponding figures for the year 1912 were 1,012, 395, 63 and 62. The time determinations were made by the Chief and First Assistants, by the eye and ear method, until October, when advantage was taken of the arrival of the Hipp tape Chronograph to instruct the Chinese computers in the use of the transit instrument and, since November 4, time determinations have been made by them at night, chronographically, and occasionally during the day by the Chief and First Assistants, who also determine azimuth error by observation of circumpolar stars once a week, weather permitting.

New spider threads were inserted in the micrometer frame on March 25, the old threads having become loose in the damp weather.

New Meridian Marks.—In the month of April two new meridian marks were erected, one to the north and one to the south of the transit instrument. The old south mark, distant 11,354 feet from the transit instrument, is frequently obscured by smoke from the ships in harbour, and its image rendered unsteady by lateral refraction over the water. It was decided therefore to erect a distant mark to the north of the transit instrument, and accordingly a stone pillar 4 feet wide and 8 feet high was erected on the side of the hills 16,655 feet to the north of the transit instrument and at an altitude of $2^{\circ}{\cdot}15'$. A vertical black line was painted on the south face of the stone to serve as the observing mark. The position of the mark was fixed by means of flag signals from the Observatory, seen by the aid of binoculars.

The collimating lens formerly used for the old north mark was transferred to the south opening in the transit room, and a pillar, similar to the old north pillar, built at a distance of 72 feet to the south of the transit instrument. The mark is a hole, $\frac{1}{8}$ inch in diameter, drilled in the vertical face of an iron plate, the horizontal base of which is embedded in the brickwork. For night observations the hole is illuminated by electric light. The old mark on the south side of the harbour is still visible above this pillar.

There is a systematic difference between the line of collimation observed by each of the three marks.

Clocks.—The Brock mean time clock was sent to England on July 20, to have an invar pendulum fitted.

The performance of the standard sidereal clock (Dent No. 39741) was generally satisfactory, except during disturbed and variable weather. It is proposed to have an invar pendulum and air pressure compensator fitted. The daily losing rate varied from $-0^{s}\cdot60$ on March 24 to $-0^{s}\cdot99$ on July 19, the temperature of the clock room on these days being 59°·1 and 85°·7, respectively, and the barometric pressure $30\cdot02^{ins.}$ and $29\cdot62^{in}$. On March 6 the one-second electric contact springs, which had been out of commission for some years, were again brought into use, and the driving weight increased by about 9 ozs. to prevent possible tripping. Unfortunately a period of cloudy weather and several rapid changes of temperature occurred after this, and no time determinations could be made until March 25, when the adopted clock correction was found to be $1^{s}\cdot8$ too small. Hence the large probable error of the time-ball in this month.

The time-ball clock (Dent No. 39740) is corrected daily by the electric regulating apparatus and its daily rate kept within $0^{s}\cdot5$ by the addition or removal of weights from the pendulum. The electric contact springs required adjustment on several occasions. On July 21 the electro-magnet of the accelerator and retarder was moved nearer the coil, in order to effect the necessary correction more quickly. It is proposed to fit an invar pendulum and air pressure compensator to this clock also.

The main spring of chronometer Dent No. 39946 was found broken on November 5, 1912, and the hair spring of Dent No. 40917 on March 8, 1913. A new spring was fitted to the latter by Messrs. Falconer & Co. It is proposed to send the former to the maker to be overhauled and to have a new spring fitted. The performance of neither of these chronometers is satisfactory. A new chronometer (Kulberg No. 8546) was received on September 22, and its rate since that date has been excellent. The mean daily variation from its monthly rate was $0^{s}\cdot11$ in October, $0^{s}\cdot16$ in November and $0^{s}\cdot17$ in December.

The electric transmitter and 5 electric dials ordered from Messrs. Gent & Co., of Leicester, in June, 1912, were received in January, 1913. Two of the dials, one in the clock room and one in the transit room, are driven by two-second impulses from the transmitter. The three other dials, and an old one-second dial, adapted for the purpose, are driven by minute impulses from the time-ball clock. A pair of contact springs on one of the minute dials is utilised for interrupting the direction register of the Beckley Anemograph, and both registers of the Dines-Baxendell Anemograph, for the first three minutes of each hour, and a second pair interrupts the velocity register of the Beckley Anemograph from the 30th to 33rd minute of each hour.

A similar pair of springs on another mean time dial is utilised for interrupting the (electric) registering light of the Kew barograph and thermograph, through a special relay designed to carry a heavy current. The thermometers of the Kew thermograph are aspirated during the last minute of each hour by means of a 12 inch fan operated, through a similar relay, by another pair of contact springs on the same clock.

Experiments with the transmitter with varying conditions of friction and arc are still in progress.

Time Signals by Wireless Telegraphy.—On the recommendation of the Director, His Excellency the Governor decided that the Colony should co-operate in the scheme proposed by the *Conference International de l'heure* for distributing time signals by wireless telegraphy.

Meteorological Conference.—In the month of May the Director attended a Meteorological Conference held at Tokio at the instigation of Prof. K. Nakamura, Director of the Imperial Meteorological Observatory, Tokio. The principal objects of the Conference were the adoption of a uniform code of storm signals for the Far East and improvements in the Service of Weather Telegrams. The Minutes of Proceedings at the Conference are being printed in Tokio.

Visitors.—Among the visitors to the Observatory during the year were:—

His Excellency the Governor, Sir F. H. May; the Rev. Father Froc, S.J., Director of the Zikawei Observatory; Mr. F. W. Tyler, Coast Inspector, Chinese Maritime Customs; and several officers of the Army and Navy (British and Japanese). Many commanders of vessels called to make enquiries concerning the weather they were likely to encounter after leaving Hongkong, and similar enquiries were fequently made by telephone.

Staff.—There was no change in the European staff during the year. Miss Doberck, the Assistant Meteorologist, was on vacation leave from May 28 to September 28 and on commuted leave from September 29 to the end of the year.

The Head Computer, Wan Suit Ngam, was promoted from the fourth to the third grade of the subordinate service on July 1, after 23 years' service.

Expenditure.—The annual expenditure on the Observatory for the past 10 years is as follows:—

Year.	Total Expenditure.	Increase.	Decrease.
	$ c.	$ c.	$ c.
1904	21,937.15	......	843.82
1905	21,220.40	......	716.75
1906	19,995.17	......	1,225.23
1907	20,110.53	115.36	......
1908	21,110.61	1,000.08	......
1909	22,388.63	1,278.02	......
1910	21,787.55	......	601.08
1911	23,353.02	1,565.47	......
1912	22,595.08	......	757.94
1913	24,255.49	1,660.41	......

Acknowledgments.—Acknowledgments are here made to the Directors of Weather Services in the Far East and the Chinese Maritime Customs authorities for daily observations and extra observations during typhoon weather; to the Telegraph Companies for transmitting the observations free of charge; to the officers of the Company at Cebu, Iloilo, Bacolod, and Malate for making and transmitting observations twice daily; to the commanders of vessels who have furnished meteorological observations, and to the Observatory staff for the manner in which they have carried out their respective duties.

T. F. CLAXTON,
Director.

1914, February 16.